

## REVIEW

# PRESENT SITUATION OF PORCINE TAENIASIS AND HUMAN CYSTICERCOSIS IN NEPAL

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**Abstract.** Human and porcine taeniasis/cysticercosis is reportedly one of the major zoonotic diseases in Nepal. Out of 250 pig carcass examined, 34 (13.6%) carcass were positive for taenia cyst. Out of 724 patients who presented with seizure at Kathmandu Model Hospital, 61% of all seizures and 72% of focal seizures were due to NCC. Forty-six cases of NCC were studied at Shree Birendra Hospital, 20 (43.5%) were from Eastern Development Region of Nepal. Data collected from 543 patients at Patan Hospital, Lalitpur were analyzed; out of which, 40 (7%) were diagnosed to have neurocysticercosis, based on clinical profile and neuroimaging. Fifty-four cases of seizure disorders were treated at Om Hospital and Research Center in Kathmandu; out of which, 24 (43.7%) patients were diagnosed as neurocysticercosis. Risk factors include the pig production system, the food culture, inadequate regulatory mechanisms, and low priority in the control program, and are the factors associated with the high prevalence of infection. Rapid expansion of small-scale pig producers and processors has led to a significant increase in cysticercosis in pigs and humans.

## INTRODUCTION

WHO estimated that 50 million persons, predominantly from developing countries, are infected with taeniasis, and 50,000 people die of the disease each year. Taeniasis refers to a human infection with the adult tapeworms: *Taenia solium* and *Taenia saginata*. The disease in human and pigs is an ancient parasitic disease that has been rooted in developing countries and is now emerging as a major health problem of global dimensions (Sciutto *et al*, 2000). The infection is also present in India, Pakistan, northern China, Thailand, and Nepal (Schantz *et al*, 1992). *Taenia* cysts were observed for the first time in pig meat slaughtered in Kangeswari, Kathmandu, Nepal (Joshi, 1973, 1991).

Taeniasis refers to a human infection caused by the adult tapeworm of *Taenia solium* and *Taenia saginata*. The infective stage of *T. solium* (*Cysticercus cellulosae*) develops in the pig, while that of *T. saginata* (*Cysticercus bovis*) develops in buffalo and cattle. The adult stages of *T. solium* and *T. saginata* are obligatory intestinal parasites for man. An infection with the larval stage of

*T. solium* is called cysticercosis. The infection frequently occurs in populations living in poor sanitary conditions, and people infected with *T. solium* can initiate the spread of proglottids into an endemic environment. Cysticercosis is, therefore, a communicable infectious disease among humans residing in poor and unhygienic communities.

Human and porcine taeniasis/cysticercosis are reported to be among the major zoonotic diseases in Nepal (Poudyal, 1998; Gaihre, 2000; Thapa, 2000; Joshi *et al*, 2001a, 2003, 2005). Particular ethnic groups, which could comprise up to 25% of the population of Nepal, are pig farmers and pork consumers with very low hygienic and sanitation practices, and with no control of pig husbandry and slaughtering. Epilepsy cases in Nepal are increasing, with studies showing that up to 7.3 per 1,000 population may suffer from epilepsy, and almost 50% of the cases are due to neurocysticercosis (Rajbhandari, 2003). Joshi *et al* (2001a) showed that the seroprevalence by ELISA and prevalence by lingual palpation was 23.5% (204 pig sera) and 32.5% (419 pig tongues), respectively.

## Background information on pig slaughtering and marketing

There are no modern slaughtering places or slaughterhouses, and no one undertake

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antemortem or postmortem examinations of the animals in Nepal. Thus, slaughtered animals are transported to the pork meat shops by bicycles, rickshaws, or taxis in a very unsanitary way, without meat inspection. The total pig population is about 935,075 in the country. Of which, 53% are reared in the Eastern Development Region; and, the Far-western Development Region represents the lowest pig population in of the country at 5% (Table 1).

Nepal, especially with people of different ethnic, religious, and food habits are equally concerned with human taeniasis, as some of the ethnic groups (Tharu) in the plains (*terai*) region keep pigs (which are considered to be the reservoirs for *Taenia solium*) as their cash crop/property that could be sold in times of need, usually during festivals.

### Risk factors

The following risk factors are associated with porcine taeniasis and human cysticercosis in Nepal:

1. Pigs are reared by the group/community of low economic status, low level of household sanitation, low level of personal hygiene, and low level of education.

2. Free-range pig rearing is being carried out by allowing pigs to scavenge and eat human feces, the cost of subsistence raising of pigs in unsanitary conditions, households lacking latrines as well as out-door human defecation near or in pig rearing areas, deliberate use of human feces

as pig feed, connecting pigpens to human latrines, indiscriminate defecation in the public areas, and use of sewage effluents, sludge, or night soil as fertilizer in vegetable crop fields.

3. Food habits and preparation of fast foods for human population is changing resulting in people having different habits of eating, human carriers involved in pig rearing, lack of meat inspection, unregulated animal traders and meat sellers selling infected pigs or meat, cultural preferences for eating raw or improperly cooked meat, risky local traditions and customs, frequent pork consumption, and low national priority for the control of pig diseases.

4. Prevalence rate in Nepal: reliable data on prevalence and epidemiological information is lacking; however, the presence of taeniid adults in certain ethnic group people is estimated to be 10-50%, while the porcine cysticercosis rates are estimated to be 14-32%.

Risk factors, production systems, the food culture, inadequate regulatory mechanism, and low priority in the control programs are the associated factors of high prevalence of the infection. Rapid expansion of small-scale pig producers and processors has led to significant increases in cysticercosis in pigs and humans (Ratala, 2006).

Meat consumption patterns in a rural farm community study is shown in Fig 1, that is, 60% people eat pork meat, and 35% mixed buffalo and pork meat. Overall, 68.2% of respondents consumed cooked pork; whereas, boiled pork was

Table 1  
Pig population by development region.

Development region	Pig population	Pig population (%)	Pork production (mt)	Pork production (%)
Eastern	495,230	53.0	7,556	49.1
Central	157,371	16.8	3,413	22.2
Western	108,449	11.6	1,879	12.2
Mid-western	126,172	13.5	1,934	12.6
Far-western	47,853	5.1	607	3.9
Total	935,075	100.0	15,389	100.0

Source: Department of Livestock Services, 2005.

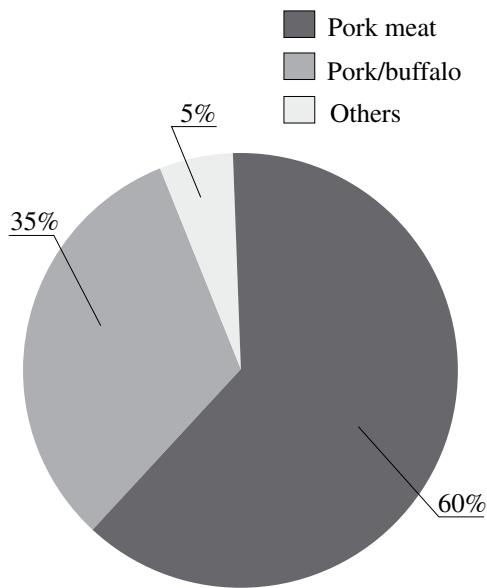


Fig 1- Meat consumption patterns in rural farm community.

less consumed by 4.3%, and only 8.3% consumed raw pork (Sharma *et al*, 2006). Pig grazing in the study area showed that about 73% pigs are raised in open fields, and only 27% in shelters. This causes risk factors in disease transmission to human and pig, thereby, completing the lifecycle of *Taenia solium* parasites (Joshi *et al*, 2006b).

## CYSTICERCOSIS

### Porcine cysticercosis

Two detailed studies were carried out in Nepal, one in Sunsari, Syangja, and another in Kathmandu valley on taeniasis in pig population during the years 2001-2005. Joshi *et al* (2001a) showed that the seroprevalence by ELISA and prevalence by lingual palpation were 23.5% (204 pig sera) and 32.5% (419 pig tongues), respectively. Validation of lingual examination with serology and DNA-PCR techniques was also studied. (Joshi and Wallingham, 2006) carried out a study in 2005 where the prevalence of lingual palpation (examination) of porcine cysticercosis was 10.5% (21/200), seroprevalence by ELISA method was 22.5% (45/200), and prevalence of *T. solium* cysticercus in the postmortem carcass organs examined was 20.5% (41/200).

The DNA analysis of cysticerci by multiplex PCR method determined them to be the *T. solium* Asian genotype. These study results showed that, out of 45 seropositive pigs, only 41 were cysticerci positive of which 21 were lingual examination positive pigs (Joshi *et al*, 2006c).

In another study a total of one hundred ten buffaloes and thirty swine were examined for the presence of cysticercosis at the various abattoirs of Rampur and Narayangath bazaar, at Chitwan. Two buffaloes (1.9%) and two swine (6.7%) were found to be infected with cysticercosis. In buffaloes, cysticerci were recovered from the liver and lungs; whereas, in case of swine it was obtained from the muscles of diaphragm and the neck (Rana *et al*, 2006).

Concerning the consumption of pork, 68.2% of the respondents consumed cooked pork, 4.3% of them consumed boiled pork, while 8.3% of the people consumed raw pork (Sharma *et al*, 2006).

**Pig carcass examined in Sunsari and Kathmandu Valley.** Out of 250 pig carcasses examined, 34 (13.6%) pig carcasses had *Taenia* cyst positive in Sunsari and Kathmaïyu valley (Poudyal, 1998).

### Human cysticercosis

**Family health parasitic survey, Chitwan.** A total of 183 stool samples were examined in the Mushar community of Chitwan. The prevalence rate of intestinal parasites was found to be 77.1%; out of which, females had higher prevalence (*ie*, 79.2%) than those of males (*ie*, 74.4%), of which the prevalence rate of *Taenia* sp was 1.6%. In this community, there was no toilet; that is, all of them defecated in the open field (forest, bank of river, etc). Out of 183 people interviewed, 107 (58.5%) of Mushars did not use a toilet but defecated in an open field. Only 76 (41.5%) people out of 183 interviewed used a toilet.

**Family health parasitic survey, KMC.** Out of 211 persons, stool samples taken in ward 19 (Joshi *et al*, 2006a), 132 (62.1%) were infected by different species of parasites, of which *Taenia solium* constituted 1.4%.

**Epidemiological study, Department of Health Services.** In one epidemiological study (Bista, 2006), it was found that higher prevalence

was seen in females (61%) as compared to males (39%).

TU teaching hospital. Sixty-six cases of neurocysticercosis (NCC) were seen at the neurology service of TU Teaching Hospital (Agrawal, 2006). The numbers of males and females were almost equal (36/30). Of these 66 cases, 77.2% presented with seizures of one or the other type. CT scans showed single ring-enhancing lesions in 42 cases (63.6%) and multiple ring enhancing lesions in the remaining 24 cases (36.3%). Maximum lesions were seen in parietal region 63.6%, followed by frontal (13%), and temporal and occipital (9% each). A total of 681 stool samples from hospital and clinics were examined (Sherchand, 2006). Tapeworm (*T. solium*, *T. Saginata*, and *H. nana*) infections were found in 52 (7.6%) cases; in which, 36 (69.2%) were infected with *H. nana*, and 16 (30.8%) with *T. solium* or with *T. saginata*, in 2005. Although people of all ages were infected, most of the cases, 37 (71.1%), were 19-50 years old; the 29-40 year-old age group was the most infected (25%).

**Kathmandu Model Hospital.** Two studies were carried out in Kathmandu Model Hospital during August 2000 to May 2001 (Neopane, 2006; Panta, 2006). Enzyme-linked immunoelectro-transfer blot (EITB) and radio imaging techniques were used to diagnose neurocysticercosis (NCC). It was found that 724 patients presented with

seizures; out of which, 61% of all seizures and 72% of focal seizures were due to NCC. The mean age of presentation was 13 years, and both sexes were equally affected. Seventy-one percent of these patients had stage II lesions (ring-enhancing lesion), and the remaining patients had stage III lesions. Sixty-nine percent of them had a solitary lesion; whereas, 31% had multiple lesions (Panta, 2006).

**Shree Birendra Hospital, Chhanuni, Kathmandu.** Forty-six cases of NCC were studied at Shree Birendra Hospital, Chhauni (Neopane, 2006), of which 20 (43.5%) were from the Eastern Development Region of Nepal. This indicates that more people of this area rear pigs and eat pork, which could be infected with the *Taenia solium* parasite. Out of 46 cases, 54% were males, while 46% were females (Fig 2).

**Patan Hospital, Lalitpur.** Another study (Chaudhary 2006) was carried out as a retrospective analysis of data of patients admitted to Patan Hospital in Lalitpur, Nepal with the

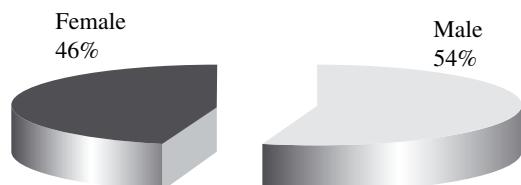


Fig 2- Sex-wise distribution of seizure cases.

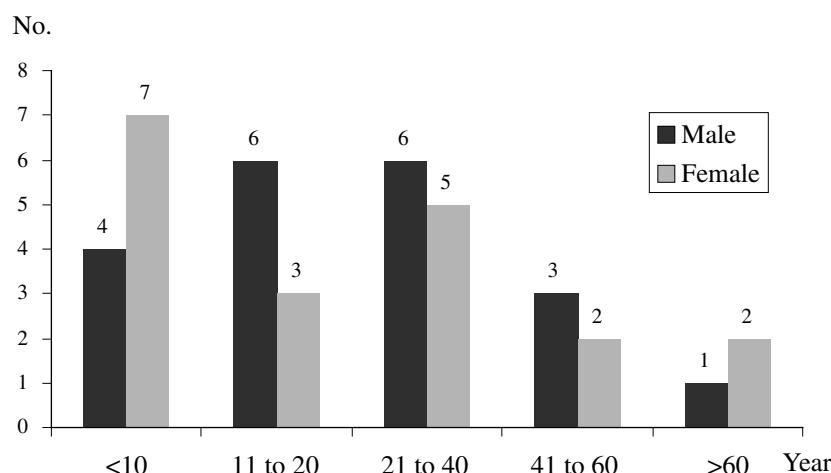


Fig 3- Age and sex distribution of seizure patients at Patan Hospital, Lalitpur.

initial presentation as seizure. A total of 543 patients' data were analyzed out of which 40 (7%) were diagnosed to have neurocysticercosis, based on clinical profile and neuroimaging. Age and gender distributions of seizure patients are shown in Fig 3. Patients' ages ranged from 2-75 years.

**Om Hospital, Chabahil, Kathmandu.** One of the retrospective studies (Sharma 2006a) included 24 cases of neurocysticercosis (out of 55 cases of seizure disorder) who attended at neurosurgical OPD, Om Hospital, Chabahil, with the history of seizures from 15 October to 15 November 2005. Over a period of one month 54 cases of seizure disorders were treated at a neurosurgical OPD, out of them 24 (43.7%) patients were diagnosed as neurocysticercosis. 23 (41.9%) patients had no intracranial lesions and labelled as idiopathic. Causes of seizures in remaining 15% were infection, tumors, congenital cysts and infarction, respectively.

## RECOMMENDATIONS

Southeast Asian countries, including Nepal, need to address important issues and risk factors of porcine taeniasis and human cysticercosis. Based on these issues, a long-term disease control plan has to be formulated and implemented by member countries with the support from WHO and other donor agencies: identifying the groups most at risk, with good prevention programs, and identifying means to increase access to diagnosis for epilepsy for the rural poor; with evidence-based treatment for NCC (Tun and Margarita, 2006). The following recommendations were made based on this review:

Ensure that pigs are protected from ingesting feed and water contaminated with human feces.

Adopt occupational health safety measures.

Strict bio-security measures should be adopted.

Keep closed herds.

Notifiable diseases should be reported to the authority concerned.

Proper herd health record keeping.

Sewage treatment is an important factor.

Clean-up an infected pig prior to slaughter.

Improve sanitation and hygiene.

Proper handling of meat and by-products.

Proper cooking of meat.

Treatment of human carrier and cysticercotic pigs.

Identify the high-risk production pockets and rural pig breeding areas and target them.

Health education for all the stakeholders.

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